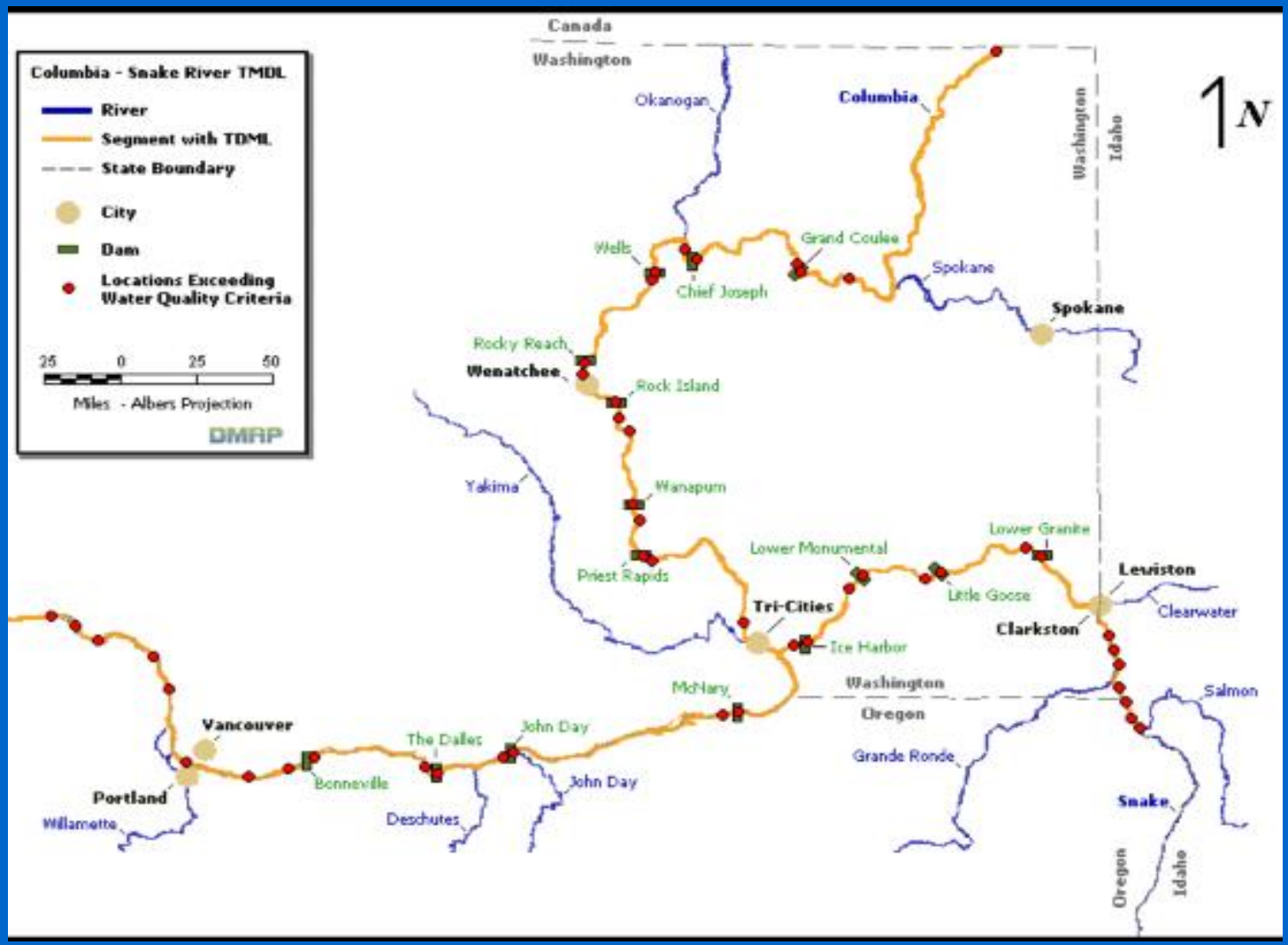
USCID TMDL Conference

Establishing Target Temperatures for the Columbia River Temperature Total Maximum Daily Load (TMDL)

Geographic Scope



Purpose of this Presentation

- Discuss how the TMDL accounts for natural variability in temperature and temperature extremes in establishing numerical targets.

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- Discuss how daily average numerical targets for the TMDL satisfy the requirements of daily maximum water quality standards.

Numerical Targets

- Water Quality Standards:
  - Numeric criteria:
    - Fecal coliform organisms - 200 colonies/100 ml;
    - Dissolved oxygen - 8 mg/l;
    - DDT - 1.1 ug/l

Numerical Targets

- However, the temperature water quality standards for Oregon and Washington are not so specific.

Washington Standard

- Main Stem along OR/WA Border: "Temperature shall not exceed 20 ☞C (68 ☞F) due to human activities. When natural conditions exceed 20 ☞C (68 ☞F) no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3 ☞C (0.5 ☞F) nor shall such temperature increases at any time exceed 0.3 ☞C (0.5 ☞F) due to a single source or 1.1 ☞C (2.0 ☞F) due to all such activities combined."

Oregon Standard

- "….no measureable surface water temperature increase resulting from anthropogenic activities is allowed: ii) In the Columbia River or its associated sloughs and channels from the mouth to river mile 309 when surface water temperatures exceed 68 ☜F (20.0 ☜C)."

Site Potential Temperature

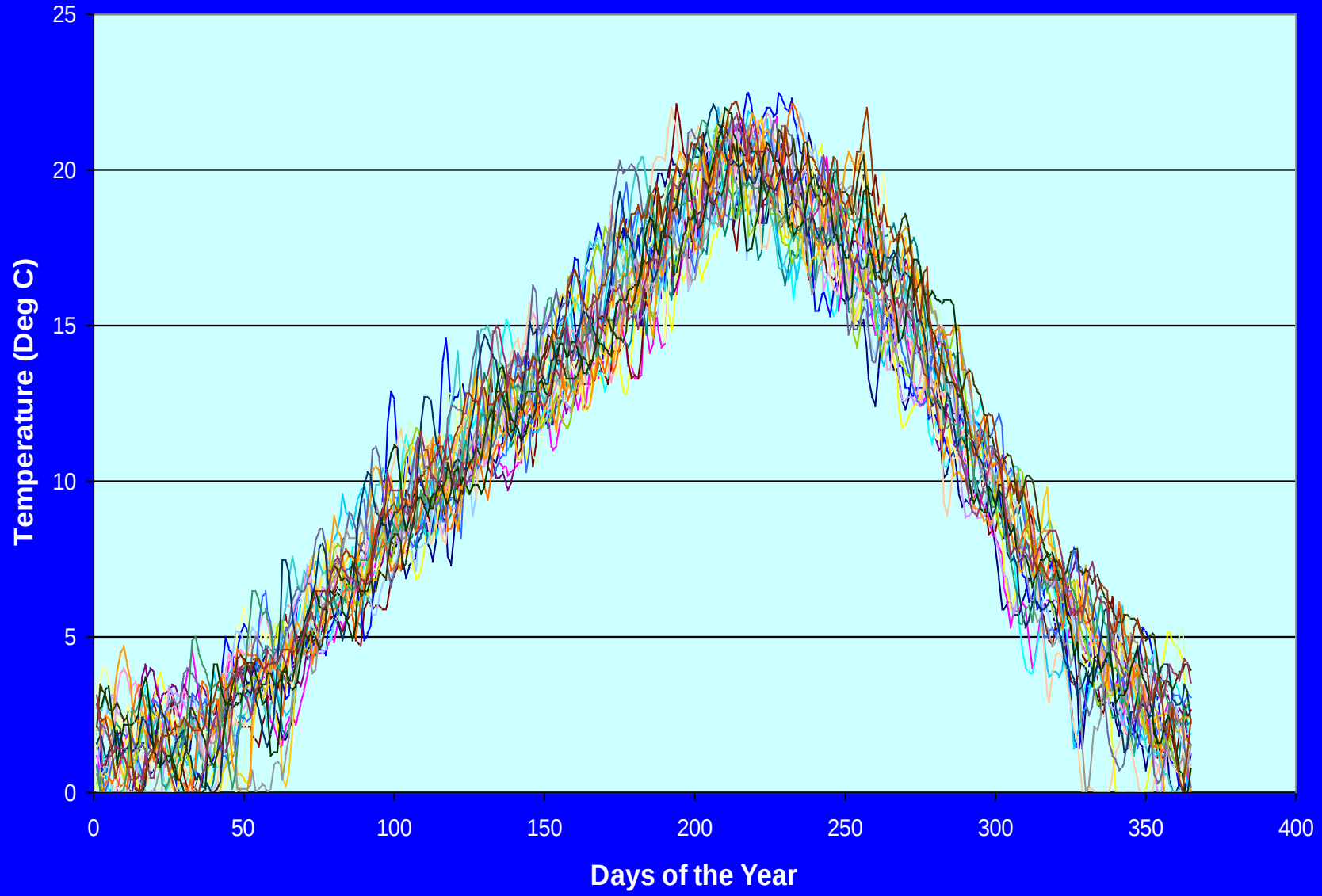
- Both states' standards are based on temperature in the absence of human activity: "Site Potential Temperature".

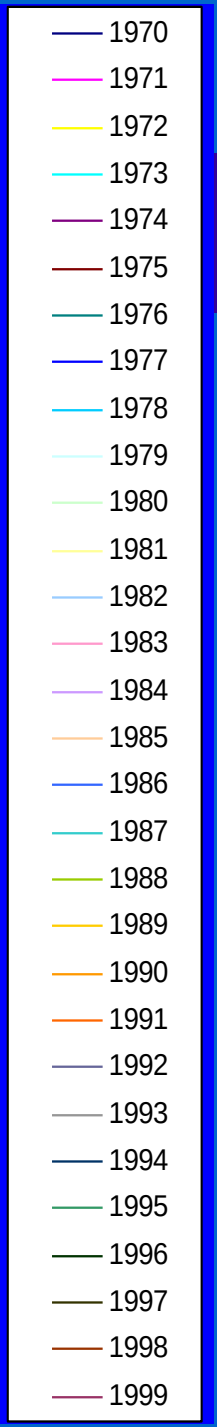
- So the numerical target temperature for the TMDL varies with the site potential temperature.

Site Potential Temperature

- Used a one dimensional heat budget model to simulate daily cross sectional average temperature in the river in the absence of dams and point sources.
- Simulated 30 years (1970-1999) of site potential temperatures using actual river flow and temperature at the boundary conditions and actual meteorology for 21 sites along the river.

Figure 3-2: Simulated Site Potential Temperatures at John Day Dam from 1970 through 1999.





Deriving the Target Temperature

- Challenge 1: Given the variability and the extremes in site potential temperature, how should the target temperature for the TMDL be derived?

Deriving the Target Temperature

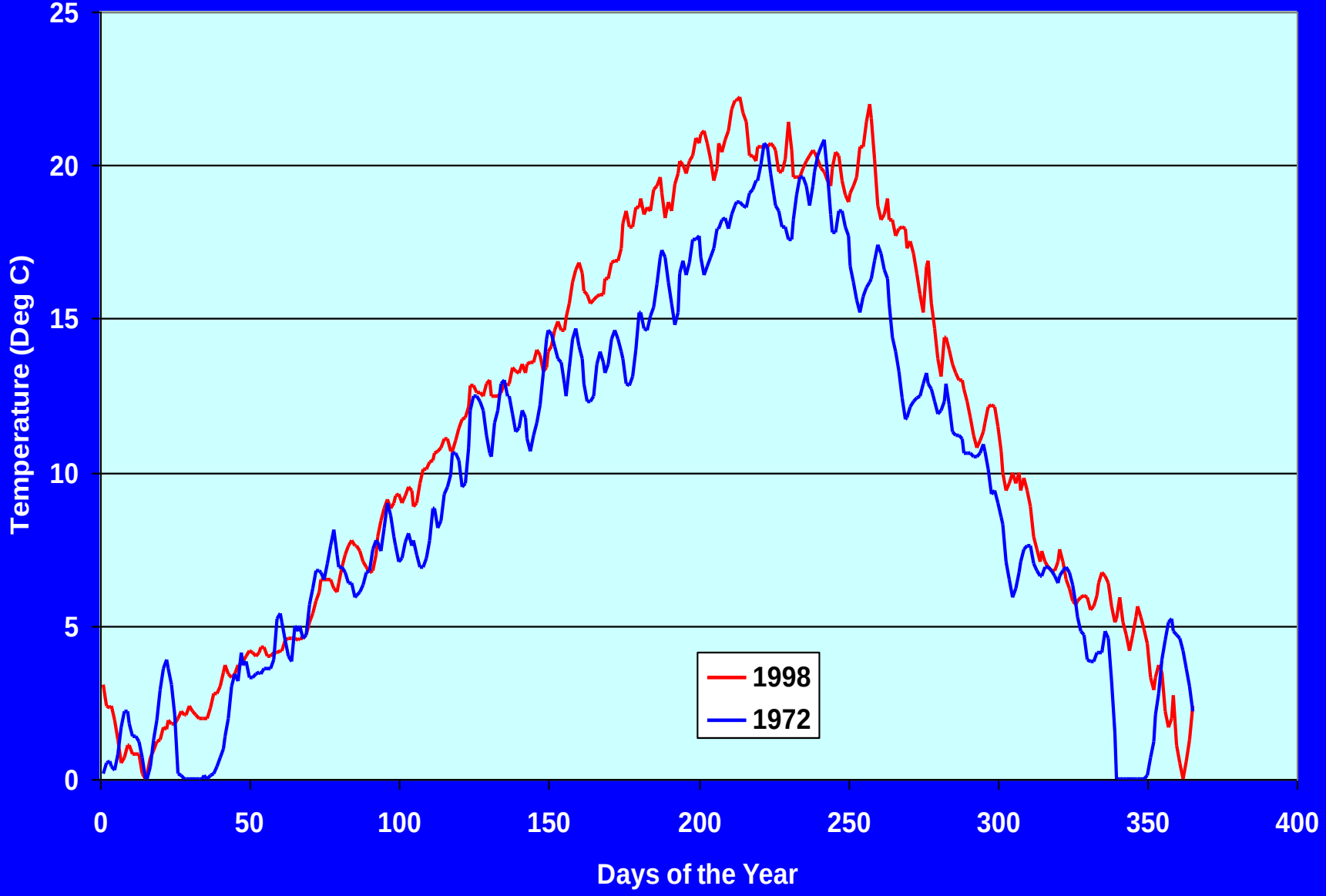
- Use the highest site potential temperatures?
  - not be very protective;
  - allow very warm temperatures throughout the year.

Deriving the Target Temperature

- Use the entire temperature regime of a warm year, such as the 90th percentile year?

- This would mean that 90 % of the years are “naturally” cooler than the “standard” year and so 90% of the time the river would be warmer than it would be without human activity.

Simulated Site Potential Temperature During a Warmer Year (1998) and a Cooler Year (1972)



Deriving the Target Temperature

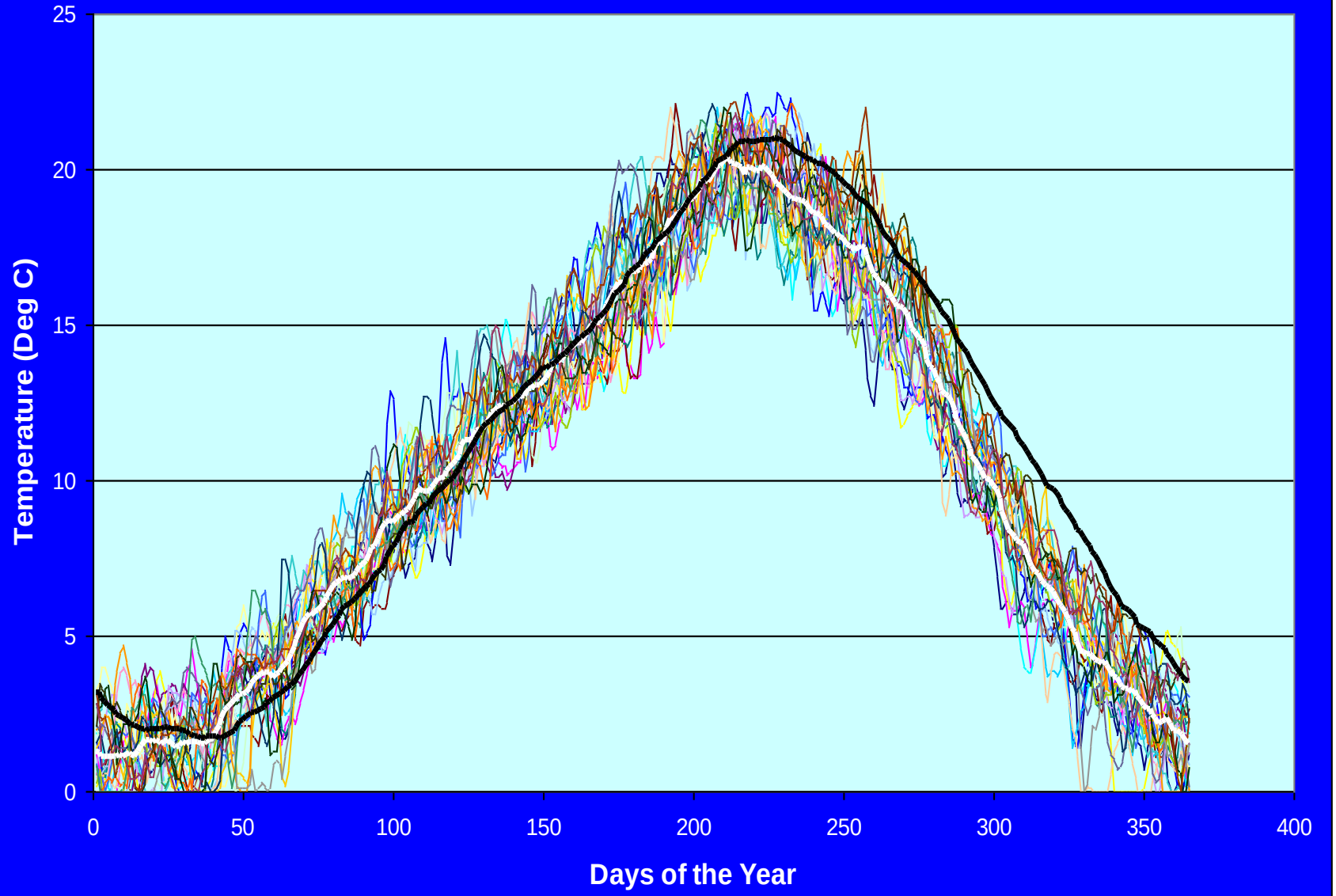
- Use the entire temperature regime of a cool year, such as the 10th percentile year?

- This would mean that 90 % of the years are “naturally” warmer than the “standard” year and so 90% of the time we would be trying to make the river cooler than it would be even without human activity.

Deriving the Target Temperature

- We decided to use the mean site potential year.
- We simulated the 30 year mean site potential temperature.

Figure 3-2: Simulated Site Potential Temperatures at John Day Dam from 1970 through 1999.



Goal of the TMDL

- The goal of the TMDL is therefore a long term goal to replicate the long term average site potential temperature.
- If the TMDL is implemented, individual years will have water temperatures warmer than the target temperature but that is to be expected because site potential would be warmer.

Challenge 2

- OR and WA water quality standards are in terms of daily maximum temperatures but the water quality modeling and therefore, the TMDL target temperatures are in terms of daily cross sectional averages.
- How can a daily average target temperature comply with maximum water quality standards?

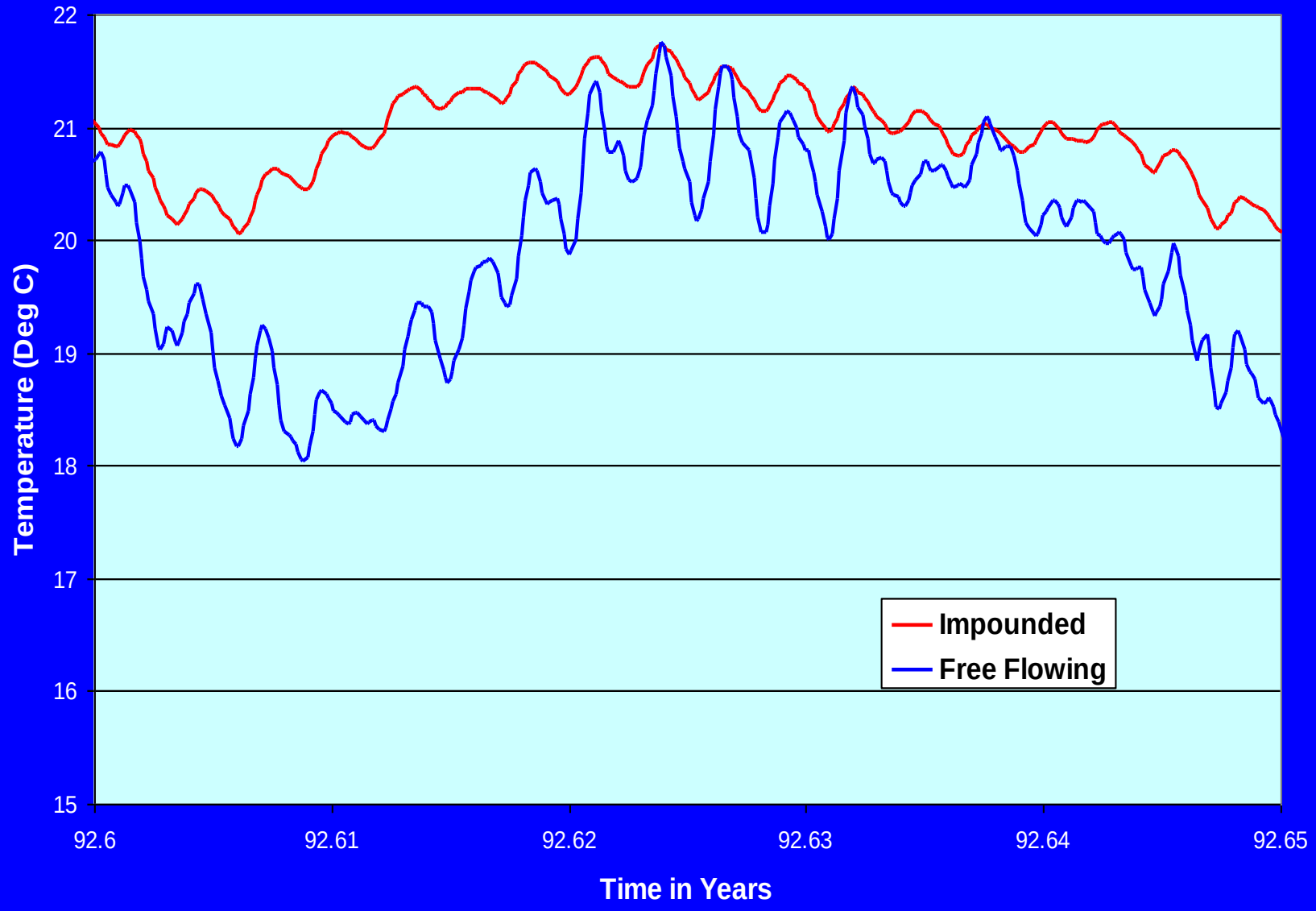
The Average is Conservative

- Because of the effects of dams on temperature, using the average as a surrogate for the maximum is actually conservative or more protective.

Dams Inhibit Temperature Fluctuation

- Generally, there is greater daily temperature fluctuation in the free flowing river than in the impounded river.

Hourly Average Temperature in the Free Flowing and Impounded Rivers at Bonneville in 1992.



Average is Conservative

- If we apply the target temperature as a daily average, the free flowing river will increase during the day more than the impounded river.

- So we will actually be a little more protective than called for by the daily maximum standard.